1.m. Jameson, Roy A. **Nº 16182**

SIFICATION OF CAVE BREAKDOWN
SON, Roy A., Dept. Geology and Geophysics, Univ. Minnesota, Minneapolis, MN 55455
own traditionally has been classified into blocks, or chips based on the number of included beds. The fication ignores actual shapes and is subject to s of scale. Rigorously applied, it ambiguously fies most breakdown as either blocks or chips, due to ure to distinguish between beds as depositional units eds as units bound by field-recognizable bed partings. classification also does not differentiate among common etic classes of endogenetic bedrock fragments. An alternative classification of bedrock fragments recognizes two endmember forms. Dissolutional forms have surfaces argely of dissolutional origin. Examples include ollapsed or detached pendants and bedrock spans. Fracture orms have surfaces mostly of fracture origin. Fracture urfaces are derived from tectonic fractures, bed partings, or fractures formed within the cave as as a result of nloading, crystal wedging, or collapse movement. Examples nclude exfoliation fragments, gypsum crystal wedging ragments, and the shatter fragments of breakout domes. Between the endmember forms are forms in which neither dissolutional or fracture surfaces predominate. Such mixed forms are common and often readily characterized both descriptively and genetically. Examples include canyon trench blocks and fault wedges. In the new classification, the terms block, slab, and chip are retained as general descriptors that are then preceeded by modifiers indicating origin or status as a common or distinctive form.

08:45 a.m. Monaghan, Marc **Nº 12086**

^{10}Be CHRONOMETRY OF GEOMORPHIC PROCESSES IN A SOIL MANTLED LANDSCAPE.

MONAGHAN, Marc, Geophysical Sciences, Univ. of Chicago, Chicago, IL 60637; MC KEAN, James, & DIETRICH, William, Geology & Geophysics, Univ. of California, Berkeley, CA 94720; KLEIN, Jeffrey, Physics, Univ. of Pennsylvania, Philadelphia, PA 19104

We have measured concentration profiles of cosmogenic ^{10}Be (half-life = 1.5 x 10^6 years) and of ^{226}Ra (half-life = 1.6 x 10^3 years) in soils that mantle the landscape of Black Diamond Mines Regional Park, Contra Costa County, California. These radionuclides were measured in an effort to constrain within reasonable and interesting limits the local bedrock-to-soil conversion rate.

In a landscape where bedrock is converted to soil by mechanical processes at a steady and uniform rate, the conversion rate of bedrock to soil (g/cm^2/y) should be equal to the ratio of the ^{10}Be delivery rate (atoms/cm^2/y) and the average concentration of ^{10}Be (atoms/g) in the soil profile, if the following conditions are met: 1) the residence time of soil on the hill slopes is long compared to annual and decadal ariations in the ^{10}Be delivery rate, yet short compared to the half-life of ^{10}Be; 2) soil is not removed rom the soil surface by overland erosion; and 3) ^{10}Be is not lost from nor transported downslope within he soil in groundwater. Furthermore, if the soils are actively mixed, the isotopic characteristics of the soil at any single point should be representative of a large region of the hill slope.

Soil samples were taken to yield vertical profiles of two soil pits dug along a downslope transect of a broadly convex slope of a hill in Black Diamond Mines Regional Park. The soil is smectite-rich, reflecting the composition of the underlying bedrock, the Nortonville Shale (Eocene). The position of the bedrock/soil interface was determined by visual inspection of the bulk physical properties of the soil and by inspection of the measured vertical profiles of ^{226}Ra and ^{10}Be. Except for the bottom-most sample from each of the pits, ^{226}Ra concentrations were fairly constant within each profile, indicating that the soil is relatively well-mixed and composed of material derived from a comparatively large region of the hillslope. In order to assess whether ^{10}Be had leached out of the soil profile, a sample of bedrock was taken 2.2 meters below the surface. The concentration of ^{10}Be in this sample, 0.52±0.07 x 10^6 atoms/g, is only 1% to 2% of that measured near the surface and thus indicates that little ^{10}Be has leached into the bedrock out of the soil.

The average ^{10}Be concentrations in the two soil profiles are 23.3±0.3 x 10^6 atoms/g and 27.6±0.3 x 10^6 atoms/g. Combining these with a ^{10}Be delivery rate reported previously for Berkeley, 1.1 x 10^6 atoms/cm^2/year, results in an average bedrock-to-soil conversion rate for this hill slope of 0.043 g/cm^2/year, or, using a local bedrock density of 1.48 g/cm^3, 0.29 km/10^6 years. This rate is similar to crustal uplift rates determined by geodetic methods for tectonically active areas in northern California.

The principal uncertainties in determining bedrock to soil conversion rates from atmosphere-derived ^{10}Be arise from the variability of the ^{10}Be delivery rate, which depends on climate; and, to a lesser extent, from a single soil profile's questionable representativeness of the entire landscape.

09:00 a.m. Nials, F. L. **Nº 04535**

LINEAR, SORTED STONE FEATURES (STONE GULLIES) IN THE GREAT BASIN ARE OF FLUVIAL, NOT PERMAFROST, ORIGIN.

NIALS, F. L.; DAVIS, Jonathan O., Quaternary Sciences Center, Desert Research Institute, Box 60220, Reno, NV 89506.

inear stone features called here "stone gullies" occur in many localities the Great Basin. Stone gullies are distinct from periglacial stone stripes d arid region mass wasting features. Stone gullies are initiated and aintained by slope runoff and effluent soil water. They are regularly aced, and are perpendicular to contour on slopes from 27 to 12 degrees. acing between stone gullies is a function of slope and infiltration acity, and is similar to that of normal gullies on adjacent slopes. The ie gullies typically occur downslope from outcrops of dense, fine- ned volcanic rocks, and where well-defined, occasionally converge or, e rarely, diverge downslope. Widths of 1 - 5 m are most common. erage stone size diminishes downward from cobbles to boulders at the face, and openwork texture prevails in the uppermost 50 cm+. The ie gullies usually terminate at a break in slope. A fine-grained miniature fan is present at the toe of many stone gullies. Topographic expression of stone gullies is minimal, most frequently expressed as a slight depression. Stone gullies have not been seen in association with stone circles, nets, garlands or soil mounds, and they are present on Holocene surfaces. Similar features have been described in other areas where periglacial conditions are not known to have occurred. Stone gullies are distinct from periglacial stone stripes, and from linear features produced by mudflows, debris flows, avalanches or other mass wasting features.

09:15 a.m. McMillan, Mary E. **Nº 15419**

USING SOILS TO ESTIMATE THE LONG-TERM EFFECTS OF FIRE-INFLUENCED EROSION, ROCKY MOUNTAIN NATIONAL PARK, COLORADO.

MCMILLAN, Mary E., Department of Geological Sciences, University of Colorado, Boulder, CO 80309.

Within the Ouzel Creek burn, soils developed on north- and south-slope catenas on a Pinedale moraine generally have A-E-Bw-Cox profiles. Soils are least developed on the summit (A-C) and better developed downslope. Soils are finer-grained, contain more pedogenic iron, and have more vermiculite and less chlorite at footslope positions. pH values are similar at most sites, regardless of location. Organic carbon values are higher for north slope A horizons. Significant post-fire erosion occurred after August 1978, when the area was burned. Erosion removed at least 1 cm of soil from a widespread area on the south slope, and from a less-extensive area on the north slope. Prior vegetation differences on the north and south slopes affected the response to fire and subsequent erosion. On the north slope, trees were more susceptible to uprooting, and fallen trees provided traps for eroded sediment. In contrast, on the south slope such barriers to erosion and sediment transport were not present. Erosion appears to have been more severe on the south slope, since there is more barren ground and a gravel lag. Burn severity was also greater on the south slope. Although widespread erosion occurred after the 1978 fire, long-term soil loss must be slow, because significant soil development has taken place.

★ **09:30 a.m.** Gillespie, Alan R. **Nº 16334**

RANGE FIRE: A DRAMATIC AND SIGNIFICANT FACTOR IN THE DATING AND EVOLUTION OF GEOMORPHIC SURFACES.

BIERMAN, Paul R. and GILLESPIE, Alan R., Department of Geological Sciences, University of Washington, Seattle, WA 98195

Range fire is a frequent and significant geomorphic process in semi arid Owens Valley, CA, removing vegetation, physically weathering rock and accelerating the diffusive loss from minerals of cosmogenic and radiogenic noble gasses.

We observed and photographed fires at Tuttle Creek, CA (1989) and Independence, CA (1990). These fires burned in sage and pinon, and desert scrub, respectively. The flame fronts were 5-15 m wide, 2-10 m tall, and we estimated that heating at most sites within the fires lasted from 2-6 minutes. Temperatures on boulder surfaces may reach ≈600 °C. Direct observation, the presence of unburned vegetation within the burned areas and the spatial distribution of fire damaged (spalled) boulders indicate that the intensity and duration of heating during a single fire are quite variable.

We modeled the effect that boulder spalling and heating have on methods of exposure-age determination. Rock-varnish dating methods are particularly sensitive to spalling damage as the entire varnish coat is lost during a spalling episode; the effect of heating on varnish is less clear although heating may serve to increase the mobility of cations in the varnish and/or toughen the varnish coat in a process analogous to firing clay.

Cosmogenic-isotope methods of exposure-age determination are less sensitive to spalling than varnish. Geologically reasonable spalling rates will make calculated ages appear too young by about 10%. Heating affects isotopic concentrations by accelerating the diffusive loss of noble gasses. Our modeling indicates that ^{3}He in quartz is particularly sensitive to fire-induced loss. However, because the intensity of range-fire heating falls off more rapidly with depth than the production rate of cosmogenic isotopes, isotope samples should be collected several cm below the rock surface so that they will be minimally affected by range-fire heating and most representative of exposure age.